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whole. If the mover is keen, he can print and distribute his arguments. As the first step in advance, I should accept your suggestion of a regular joint-committee of faculty and trustees. As the second step, I should abolish all salaries of deans and directors. I should put extra-faculty permanent clerks in training. Meanwhile, if a faculty-member has to be dean or director, I should excuse him in so far from university work, but should allow him only the professorial salary. I should aim throughout at the realization, by every member of the faculty in the widest sense, that he must be both responsible and loyal to the university, *i. e.*, to his fellow faculty-members and to the students. I should hope that in time the idea of the "university" might include the trustees; though it will, I fear, be long before the professor ceases to regard the trustee as his natural enemy, and the trustee to regard the professor as a fool to be kept harmless. I should hope, also, that in time the whole university, faculty and trustees, might be capable of combined action on definite educational lines; even if this took a generation, I should not mind. I dislike difference of title; and I should hope that in time there would be no difference, save of permanency of appointment. We should then have, perhaps, professors elect and professors designate, and that is all; perhaps we might even abolish titles altogether. I do not believe in specially high salaries within the university. A great deal of this is, under present conditions, utopian; I do not think that I could myself live up to my ideals; brutalities and jealousies warp one even against one's will. But I think that with some suffering and many relapses for a generation, the utopia might be approximated.

Your general summary of university evolution from comparatively small colleges to their present dimensions and complex interrelations I have seen with my own eyes. I think that every one who has helped in the evolution of the American university to the present stage expected a simpler organism than actually came from their efforts; and perhaps sometimes we feel hardly willing to accept our own

creation. As you say, there was comparative order and simplicity in the smaller institution; but there is now complexity, and reversing the order of the creation described in Genesis, there is considerable chaos as a result of our creative efforts. But we are not through yet, and in some such plan of representative government as you have outlined, I believe a glorious youth and maturity are before the American university. To answer the questions in order: (1) This is practically the system I have lived under. (2) This seems to me an unnecessary complication. In No. 5 there would naturally be a chairman chosen for the group or groups meeting together. (3) This is entirely practicable and works well. (4) This is the kernel of the whole matter, and by contrast brings out the real difficulty in American universities. We are too much "boss ruled," and have too little of the true principles of self government; and self government is at the root of all permanency in a free commonwealth whether political or educational. The method you propose, in part, I have lived under and know that it is practicable. I have also lived under a system in which over-lords were appointed by a higher over-lord to rule over each province—in a word "boss rule"; and it destroys the fine spirit of a university as it does that of the state and the nation in political matters. I think that in no situation in life is leadership more desired and appreciated than in a university; but leaders, to be followed, must be chosen by, not imposed upon, a faculty group. (5) This is a logical sequence to (4).

LETTERS FROM THE UNIVERSITY OF CHICAGO

I FEEL very little sympathy for the type of organization which you recommend. I spent seven years in an institution which had a democratic organization on its faculty, and I am persuaded that that organization is defective in more ways than the organization at such an institution as Harvard or Chicago. It is defective first, because of the difficulty which always arises when one tries to convert a body of men to new and progressive policies. It is very much easier to get the ear of one

intelligent administrator, and carry through a policy of reform, than it is to get the sympathy of a number of heads of departments. In the second place, I do not believe that heads of departments are as efficient when it comes to deciding general policies for an institution as some detached executive officer who can look beyond the interests of each of the departments. The experience of such institutions as Yale and Cornell seems to me to be conclusive against the democratic organization. They found exactly the same difficulty in Cornell and voluntarily voted away the authority which they at one time held. I am not optimistic, either, about the ability of academic men to organize their own government. I think that the specialist in science or literature prefers to have somebody develop the methods of scientific organization and relieve him of the necessity of considering these matters. In other words, an administrative officer equipped with methods of investigating his own problems seems to me to be a very proper solution of the difficulty in which we now find ourselves.

As regards your first proposition, I may say that it seems to me at least harmless. If it resulted in attaching to the university a larger group of serious-minded and intelligent persons than is at present the case, I should think it in so far useful. I am not clear that the chancellor, for whom you make provision, would be a particularly useful official, unless he were content to remain largely ornamental, as is often the case in the English universities. His usefulness in that case would be of a sort not likely to come into conflict with the policies adopted by those more directly responsible for the conduct of affairs. Your proposition under the second heading to elect a president from the members of the faculty and to give him no larger powers and no larger salary than is received by other members of the faculty strikes me as somewhat impracticable. I can not imagine any man whose intellectual capacities and attainments would justify his presence on a faculty of a first rate modern university, who would be willing to

make the sacrifice of time and strength necessary to assume administrative control under such conditions. Possibly members of the department of education might find in such a function a professionally advantageous occupation, but for other members of the faculty it could only be a time-consuming and thankless job from which the abler men would unquestionably shrink, and presumably would succeed in avoiding. The idea that the faculty should have some voice in the selection of a president I heartily approve, but our own generation seems not to be in sight of such a distribution of administrative detail as would justify any able scholar in turning his attention to this phase of university work were he not rewarded by some increase in his salary or his powers. The application of your suggestion in point three meets my hearty approval. Experience has abundantly shown that we need a smaller unit of organization with very definitely specified responsibilities if we are to secure effective and intelligent participation by members of the faculty in university government. The fly in this particular ointment comes at the point where the interests of any particular group may run counter to those of some other similar group. You provide in your fourth paragraph that such a group shall have as complete autonomy as is consistent with the welfare of the university as a whole. This means that some one has got to decide whether the welfare of the university is or is not in any given case invaded by the action of one or another department. You will then have to fall back on a larger body, or on some administrative official who may prove to be an unjust judge. I do not regard this difficulty as insuperable, but I could relate instance after instance in which it has proved practically very serious. I approve also very heartily the spirit of your suggestion in paragraph four that nominations to professorships shall be subject to a competent advisory board. You supply a rather undue amount of machinery for this purpose, but some check of the kind represented by a competent board is certainly highly desirable. I also approve the sugges-

tion whereby each unit should have control over the expenditure of its own funds. I feel that at the present time a large part of the most irritating difficulties which members of the university faculty encounter concerns the necessity they are under of making a purely personal appeal to the president and trustees instead of being able to distribute as they may think wise a specified portion of the university funds, and instead of being permitted to augment those funds as they may be able. Your final sentence in paragraph five is a gem. "There should be as much flexibility and as complete anarchy throughout the university as is consistent with unity and order." In other words, there should be a chaste and orderly disorder. This also I sympathize with, though the actuaries give me no reason to hope that I shall survive to see it in operation. In general I feel very strongly that the present situation has many very undesirable features attaching to it, of which not the least is that the president tends too largely to become a purely fiscal officer whose interests and outlook are almost wholly financial in character. No doubt this aspect of the great modern university must be cared for, but I think it is a great misfortune that the more purely educational and scientific interests can not be placed upon a more autonomous basis whereby for any given year at least, or indeed for any period of five years, the authorities in charge of a division of the work of the university may know to a nicety the minimum sum at their disposal, and may be permitted to expend it as it seems to them best. The subserviency to the president and trustees which the present system breeds is both morally and educationally wasteful in my judgment, and that it produces a destruction of esprit de corps and the higher forms of loyalty is too obvious to be debated.

In a general way your scheme of university organization seems to me to be an admirable one, although there are a number of difficulties which the plan has in my mind. In the first place, I think the plan of operation would work out very much better in an

organization having a considerable degree of homogeneity than in a university having a very large number of academic and professional departments with little or nothing in common, and frequently with sharply conflicting interests. Might it not happen, for example, in a school of the latter sort, that the professional interests, which are usually rather rabid in their demands on account of their practical value, would completely outweigh those of pure science and academic work? It seems to me that we might expect exactly this to happen when the law, engineering and medical faculties are brought into contact with the pure science groups, and it is especially injurious to the interests of the academic and pure science groups that the applied schools have a larger number of faculty members than the academic and strictly scientific bodies. If all productive endowment were divided up so that each general group in the university would have its own funds, and was to all intents and purposes an independent school financially, the difficulty would not be so great, but if all the funds were contained in one general endowment I think there would be serious difficulties which would prove most injurious to the things most worth while in our university. This is the most serious phase. Secondly, with regard to the constitution of the corporation. It seems to me that the admission of any very considerable body of alumni and members of the community where there is sufficient homogeneity of interests might be all right. On the other hand, would there not be the danger of getting in those who gain their popularity from their fellows through athletic contests and social position, rather than through real worth or capacity to take part in the deliberations of the corporation? It might also lead to a situation in which the faculty would be compelled to take cognizance of temporary, erratic, social beliefs. Still, leaving out these difficulties which are not insurmountable, the plan of organization proposed under (1) is probably better than that in vogue in our institution at the present time. The various provisions provided for under (2) seem to me to be rather desirable,

and need, I think, no comments. I am not sure, however, that your suggestion of an annual election of a director is a wise one, because the complexities which exist in an institution of this kind, I imagine that it would take the larger part of the year for a man to learn the task before him. A period of five or ten years might be highly desirable, and I would also suggest that some sort of provision be made for referendum and recall when the administrative officer is no longer satisfactory or when his policies become unbearable to the rest of the professorial body. I think opinion would differ very much with regard to number (3), especially with regard to the size of the group which you suggest as a psychological constant. In principle, however, these aspects of university organization seem to me to be admirably conceived of and very much in advance of the present arrangement. In (4) and (5) I think I have nothing to comment upon. I am in harmony with the principles expressed therein, with the single exception, under (4), that the division should have financial as well as educational autonomy, which would depend upon the type of financial organization adopted in the institution. I judge that your plan would be to have a series of separate endowments for the departments. I would like very much to see this sort of thing put into operation and see how it works out.

It must be clear to every one that in the small college of earlier days the president's ideas on college policy and the policy of his college were almost or quite identical. Furthermore, the college seems to be about as conservative an institution as we have in this democratic country. This early college president was usually conversant with practically all the subjects taught in his college. The number of subjects was limited and confined almost entirely to the classics in which the president had received his own training. Since that time the sciences and humanities have been differentiated into so many subjects that no college president pretends to know much about many of the fields of work

covered in the college curriculum. It must be equally clear that in order to represent the interests of all these various departments the opinions of all must be considered. The field is certainly too broad and too specialized to enable any one man to govern all of them adequately and justly. If the faculties were incompetent that of itself would be justification for a continuation of the earlier policy, but that claim can not be upheld. Democratic government of a university would certainly make a place for utilization of the intelligence and sympathetic cooperation of the large number of men who are really interested in university administrative affairs. To speak of your propositions by number I wish to say: First, that responsibility placed upon a larger number of men is certainly desirable and your plan for securing it appeals to me. Secondly, the president certainly should be selected because of his "expert knowledge of education and university administration." I do not quite see how it would be possible to have a president and a chancellor both operating to the best advantage to the university without having their fields overlap considerably. For example, the public is quite as much interested in the educational aspects of the university as in its business aspects and in its connection with public affairs. Thirdly, the departmental unit seems best to me. Fourth, in a great many of the universities at the present time appointments to major positions are made only upon nominations which are the result of careful consideration by all the faculty of the department in question. It seems desirable that that plan should be made general. Fifth, I like the proposition of number five if we assume that the senate or the general faculty of the university has prepared a full and definitely stated constitution outlining the policies—administrative, financial and educational—of the university as a whole. This policy should be general but definite and should leave autonomy to the departments on all questions that are at all likely to concern departments only. But general policies should certainly be stated in a general constitution that would

outline the functions of the university as a whole.

Your suggestion (1) seems to me a good one, in that it would restrict the powers of the board of trustees to those affairs of the university which are non-educational and at the same time dignify leadership in that very important department of university administration. I am not sure that I should like to see a university faculty, as a whole, take part in the election of the president, but it seems to me that the faculty should have influential representation by a committee composed of its most influential men, possibly elected by the faculty as a whole, on the appointing body. The division of the interior administration of a university into parts seems to me essential to economy, and I think that the association of a committee or member of the board of trustees with each of the partial faculties would tend to a better understanding between those interested in the educational and the other work of administration. The question of appointments and promotions seems to be a difficult one. Your plan seems to me well suited to insure good new appointments but I am not so sure about appointments which are also promotions. In either case it seems to me that the department concerned should be well represented by an elected committee, and the final appointive power should be vested in a number of men rather than a single one. I do not believe that any two men holding the same kind of position do the same amount of work, and think that the salary should be adjusted accordingly, possibly between limits specified for the particular office in question. Many good men are lost and others lose ambition when a salary schedule is rigid. I like the idea of a university senate working in coordination with the trustees, and the ideas expressed in your section (5) for bringing the trustees and faculty into closer touch with each other.

The plan you propose seems to me to be excellent for an institution that is given over

largely to teaching. In smaller colleges the various members of the faculty see each other frequently and each keeps in touch with the work of the institution. Your plan, as I understand it, contemplates similar intimacy among groups in the larger organization. While I believe that your plan would work well and be a great improvement in an institution given over to teaching and in which the proper care of the students and of their problems was of first importance, it seems to me that a university that attempts to make research its highest aim, would have difficulty in carrying out your plan. At present, with the autocratic form of government which we have here, the research men complain bitterly of the amount of time required for committee work, faculty meetings, etc. Your plan would increase the demands on them in this respect. Since my main interest is in the teaching side and in research in education, I would like to see your plan tried, but I feel certain that the men interested in research in science will object to it for the reason stated.

(1) This paragraph seems to me good, though the plan referred to in the footnote of deriving income from fees from members of the corporation is bad. Either the income so derived would be small or else the financial burden on the trustees would be such as to encourage the selection of trustees on the basis of their financial rating. (2) The president should be elected by the faculty, but the office of president, like that of professor, should be a permanent one for the sake of continuity and stability of administrative policy and the precise localization of responsibility. The salary should be adequate to get the best available administrator regardless of salaries paid to other officers. Much more important than the president's salary is the control of the university budget, which should be taken out of the president's control and lodged with the faculties or senate. (3) Good. (4) This I approve, save that I think it unnecessary that the professors' salaries should be uniform. Footnote 8 seems to me especially sound and important. (5) This commends itself to me as good. In general, I

think the plan proposed or slight modification of it is both good and practicable.

In general, the proposed scheme for university control appeals to me as excellent. I particularly approve of the statement to the effect that the fundamental difficulty in the situation lies in the fact that the president is responsible only to the trustees, while the professor is responsible both to the trustees and to the president. We are having a little experience in connection with note 6, having two practically independent institutions for research, closely affiliated with the university, and so far it has been a very satisfactory arrangement, at least from the side of the independent institution. What the university thinks of it, I can not say.

Your tentative proposal regarding the organization of our larger universities seems to me to be a lead in the right direction in that it aims to curtail the autocratic power of the president and to place the whole organization on a more democratic basis. I am not so sure, however, that the proposed changes would work out in practise, for even in some of our most democratic institutions there exists a tendency towards centralization of control. As an example of a university controlled by a corporation composed of professors, alumni and interested members of the community, one might cite the Marine Biological Laboratory at Woods Hole, where the actual administration is largely in the hands of the director. Ordinary members of the corporation have little or no voice in directing the policies or business of the institution. Although an annual meeting of the corporation might seem to furnish an opportunity for the ordinary member to exercise his franchise, this is really not the case, as all matters, including election of officers, are settled before the meeting. Thus may our most democratic bodies revert to oligarchy. It must be admitted, however, that we have in the Marine Biological Laboratory a close approximation to the ideal university conditions. In my opinion one of the most serious objections to the present

autocratic type of university president lies in the fact that he may be, and sometimes is, a man of little force, readily influenced by certain of the more dominant members of the faculty, who are able to mould his policies often to their own personal ends. Thus arises favoritism, financial and otherwise, toward departments, which happen to have at their head men often of low scholastic attainments but highly endowed with the qualities of political leadership or merely with a pleasing and persuasive personality. The department headed by a man or men of scholarly tendencies and little or no time or inclination to curry favor, may, and often does, fail to receive a fair amount of encouragement or support.

There is no question of the need of some reorganization. The fact of the establishment of research institutes independent of the universities shows, I think, that the universities have lost the confidence of those desiring to aid research; and investigation is the *sine qua non* of university existence. For this our organization appears to me to be at fault, the main trouble being that the universities are actually not in the control of their faculties. The plan you suggest would return that control and is, therefore, good. Your general plan strikes me as very similar, with some additions, to that of the Marine Biological Laboratory at Woods Hole. This has worked extremely well in that institution. While the criticism is sometimes made that scientific men and scholars can not be trusted to manage funds, the Marine Laboratory entirely disproves such a notion. No institution in the country has made so little accomplish so much as the Woods Hole laboratory. I am a little uncertain what the duties of the president would be under your plan. I am inclined to think that the only men who are really competent educators are the scholars, and I fear you will have difficulty in finding any scholar willing to assume the duties of a president unless he have some additional recompense either of salary or power or honor. Certainly the president should be elected by the faculty, or the trustees should elect from

two or three men nominated by the faculty. The organization of departments into autonomous divisions is a good scheme. We have lately adopted unofficially something of this sort here in the form of an advisory committee of all the biological departments. It works very well. This committee recommends to the president on biological affairs of general interest. As regards the organization of a department, I believe it makes little difference whether there is a head chosen by the president or a chairman elected by the department. I have lived under both systems. Each is good with the right kind of men in the department and each is bad with the wrong kind. I should like to see the plan tried.

I thoroughly agree with your general principles, especially with your demand that each department should have as complete autonomy as possible, and that there should be as much flexibility and as complete anarchy throughout the university as is consistent with unity and order. But it seems to me that your specified list of desiderata is somewhat too detailed, considering the great diversity of American universities. In particular I think that different rules ought to be laid down for the college and the university proper. I also doubt whether your method of appointing professors is the best. I think it dangerous to give any body of professors, except those in the special department concerned, a deciding influence upon the appointment.

The plan suggested seems to me to be admirable. I wish to emphasize my belief in the desirability of those features of the plan suggested in paragraphs (1) and (2), and in that part of paragraph (4) which deals with the nomination for professorships. The present system of control is, at least in most institutions, highly unsatisfactory and moreover is not really effective.

Of course, if I went through your paper with a fine comb, I could probably find something to criticize, but reading it in a proper

spirit I find that it grows on me, and that the oftener I read it the more anxious I become to see it put in force. One criticism that first suggests itself is that there is nothing hard and fast about the plan, but that you offer alternatives wherever possible. This elasticity, however, is one of its good points, for the new method of controlling the university, if there is to be a new method, can not be put in force all at once in a state of perfection, but will have to be more or less experimental. It has seemed to me with the growing power of the president there has been a distinct retrogression in some directions, and that the great American universities of to-day, with their thousands of students, their hundreds of professors, are in some respects behind the small freshwater colleges of a generation ago. The president in many cases seems to look upon the university as his own property to be exploited for his own aggrandizement. He wants to be the "whole thing," and selects his professors, not on account of their fitness or researchability, but for personal reasons, and because they will toady to him. The independent man is made to feel that he is not wanted, and although his tenure of office is theoretically for life, things are made so uncomfortable that he is glad to leave. It has seemed to me that some of the presidents do not want men on the faculty who are bigger than they are, and although here and there a university may become great through having a truly great president the system is bad and should be eliminated.

I have read your article "University Control." It is most timely. I doubt if I can add anything of value to it. The trouble with the university president is often that he has to spread over too much ground and comes to rely upon the busybody who has the president's ear and a bag-full of rumors for his "information" upon which to base promotions. Also, if he takes his job seriously he will periodically "butt in" to the doings of a department of which he has only the most superficial knowledge. The university president should adopt the principle of relying on

the professor and according him full liberty in his department. If suggestions are in order, I might offer the following plan of making appointments and promotions. The department committee to nominate first appointments to assistantships and other low-grade positions. The division (department group) committee to nominate for promotions or first appointments to instructorships. The body of full professors of any faculty to nominate to professorships in that faculty. Professors in all faculties to nominate the president. All elections to be by the trustees or corporation. The president to be elected for a limited term, and subject to "recall" by the faculty. The president to confer with professors, represent them before the trustees, and the university as a whole before the public. The executive agent of the trustees (comptroller), the president, and a prominent alumnus (elected by vote of the alumni or their representatives) to constitute a "board of estimate." Such a committee would unite the needs of scholarship, the good-will of the community and the limitations of the treasury and arrange the delicate adjustment between departmental needs and university income.

I am heartily in favor of some such plan of university administration as you propose. At present in some institutions control rests in the hands of a small group of trustees who happen to have the leisure, or the money, or the energy to take a leading part, but who are not necessarily qualified to understand the real problems of the American university. The trustees appoint the president, the president appoints the deans, the deans recommend departmental appropriations and promotions, and so a personal tinge is given to all the official relations of the regular faculty members. The present situation is purely fortuitous. Until the natural university groups are given complete autonomy, genuine university development and continuity must remain largely a matter of accident. In your plan as stated the principles outlined in sections (3) and (4) seem to me essential. Pre-

cise details must naturally be left for experiment.

Upon the whole your plan is quite in accord with my own views, and I believe that there is already a tendency among our universities toward its inauguration in part. I doubt the expediency of the chancellorship, nor do I think such a corporation as you suggest is at all practicable for the state universities, though possibly some plan whereby the elected or appointed state regents might be limited to the control of funds and to an indirect or direct veto of all matters not strictly academic might be feasible. Especially do I think that the presidency should be an elective office of the faculties. At present the highest honors and emoluments are given, not for scholarship and pedagogical excellence, but for executive and administrative ability.

I am in hearty sympathy with the proposed plan for university control. It is quite preposterous that in a republican form of government our institutions of learning should have what is practically an absolute despotism—while the universities of Europe are the most democratic in their form of administration. I doubt, however, if it be possible—without a disastrous revolution—to change the present status.

I have been president and professor in a state university, and in denominational colleges, and have added to this now my fifteen years' experience here. This simply means that I have looked at the problem of "control" from almost every angle. My conviction is that every group connected with a university should do what it is best fitted to do. Theoretically, the trustees are fitted to conserve and increase endowments, and no more. They should have nothing to do with determining educational policies or with selecting instructors. Theoretically, the faculty are fitted to determine educational policies, to select instructors and to distribute the available funds. As I understand it, these are the views you have worked out in the details of your scheme, and so it has my general

sympathy. But my long experience with faculties has led to the belief that they are made up, for the most part, of very impractical men. They seem to me to be childlike in their selfishness and their idealism. I believe that this is largely due to the fact that they have been kept in childish bondage, and this simply means that they will have to be entrusted with large administration gradually. I certainly disapprove of the autocracy of the American university president, since I have ceased to be one. No developed institution needs any such dictator. It is not right for any man to hold such a relation to his intellectual peers. The details of your various propositions may be open to discussion, but their general bearing seems to me to be sound.

SCIENTIFIC BOOKS

Outlines of Applied Optics. By P. G. NUTTING, Associate Physicist, Bureau of Standards, Washington, D. C. P. Blakiston's Son & Co. 1912. Pp. 234.

A generation ago text-books on physics, or special sections of physics, came for the most part from those who were connected with the higher educational institutions of the country. They were usually written by men who were teachers besides being physicists, and who instinctively assumed that the reader demanded a consistent presentation of mutual relations rather than of results.

With the development of large and well-equipped laboratories, some of which are wholly independent of educational aims or limitations, a new range of scientific literature is becoming developed, in which specialization of function is not limited to the author, but assumed equally for the reader. The non-technical reader is attracted by a title, and is assured by an introductory glance that the book contains much of value. He is not disappointed, but is perhaps temporarily disturbed by the necessity to shift his customary view-point.

The author of the present volume announces as his keynote the question of securing the best possible results in optical work. He calls attention to the fact that applied optics is

practically untaught in any university. This statement is perhaps a little sweeping, but it is applicable to many of the institutions that in America are called universities. He says frankly in his preface, "the book has been prepared for the worker in applied optics rather than the student; for the men in the field designing instruments, measuring color, examining eyes, identifying illuminants, etc., who may find a suggestion of how to obtain better results or ready information on nearly related subjects."

No one would be apt to open a book on optics who has not already some knowledge of the subject, such knowledge as would cause him to recognize the formulas most commonly in use, besides recognizing the application of principles that are thoroughly established. A well chosen summary of some of these principles occupies much of the introductory chapter, including the formulation of laws connected with names of such investigators as Lambert, Bouguer, Fresnel, Kirchhoff, Stefan, Planck and others. Discarding some obvious typographical errors, and the use of a few words which need explanatory introduction for most readers, the chapter is welcome and interesting.

The second chapter is on the theory of image formation, a subject which bristles with difficulties for the student who aspires to master the various aberrations and the means to be applied for their elimination. The satisfactory presentation of such a subject requires much pedagogical skill, apart from knowledge of the mathematics involved. Pedagogically the author has not always kept in mind some of the principles which every successful teacher must habitually and almost automatically apply, if he wishes to assure himself that his auditors or readers are acquiring power rather than accepting underived formulas on trust. Technical terms are used without adequate definition, and various equations are set forth without deduction. Assuming that the intelligent reader has already studied the subject in detail elsewhere, the chapter constitutes a condensed summary; but to assure himself that he understands everything while reading,